A&P Chapter 2: Chemical Basis of Life Cheat Sheet

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Essential Elements

Bulk Elements	required by the body in large amounts	Oxygen Carbon Hydrogen Nitrogen Phosphorus Sulfur
Trace Elements	required in small amounts	Copper Iodine Iron
Ultratrace Elements	required in very small amounts	Arsenic Boron Nickel Silicon Tin

Principle Elements in the Human Body

Element	% of Body Weight	Function
Oxygen (O)	65%	Component of water, essential for respiration
Carbon (C)	18.6%	Found in all organic molecules

Principle Elements in the Human Body (cont)

Hydrogen (H)	9.7%	Component of water and most compound in the body
Nitrogen (N)	3.2%	Found in proteins and nucleic acids
Calcium (Ca)	1.8%	Found in bones and teeth, needed for nerves and muscle contraction, blood clotting
Phosphorus (P)	1%	Found in bones, teeth, ATP
Potassium (K)	0.4%	Necessary for membrane function, nerve impulses, and muscle contractions
Sodium (Na)	0.2%	Necessary for membrane function, nerve impulses, and muscle contractions

Principle Elements in the Human Body (cont)

Chlorine (Cl)	0.2%	Important for membrane function and water absorption, major component of stomach acid
Sulfur (S)	0.04%	Found in many proteins
Iron (Fe)	0.007%	Essential for oxygen transport
Iodine (I)	0.0002%	Component of hormones of the thyroid gland

Ions

Name	Chemical Symbol
Sodium	Na^+
Potassium	K^+
Calcium	Ca^{2+}
Chlorine	Cl^-
Bicarbonate	$HCO3^-$

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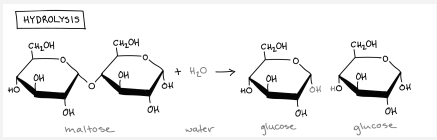
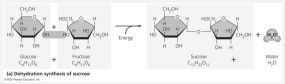
Catabolism



Catabolism (Decomposition): breaks molecules into smaller fragments

Anabolism



Anabolism (Synthesis): assembles larger molecules from smaller ones

Exchange Reactions

Exchange Reactions (replacement): reacting molecules are rearranged

Reversible Reaction

Inorganic vs Organic Molecules

Inorganic	Organic
No C and H together	Contain C and H
Smaller molecules	Larger molecules
Dissociate in water	Dissolve in water
Water, oxygen, carbon dioxide, and salts	Carbohydrates, lipids, proteins and nucleic acids

Organic Building Blocks

Carbohydrates

Contains C, H, and O (often end in the suffix "-ose")

1:2:1 ratio

Monosaccharides and Disaccharides (simple sugars): provide energy

- Monosaccharide examples: glucose, fructose, galactose
- Disaccharide examples: sucrose, maltose, lactose

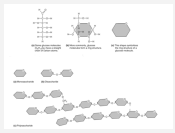
Polysaccharides: store glucose

- Examples: glycogen (in liver and muscle)

Glycoproteins and Glycolipids: on cell surfaces, aid in cell communication and recognition (ID tags)

- ex. MHC proteins, T-cell receptors, blood type

Carbohydrate Structures



Triglycerides

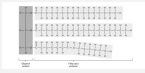
Functions:

- Used primarily for energy storage
- More energy rich than glucose
- Cushions and insulates the body and nerves (myelin sheath)

Structure:

- Made of 1 glycerol and 3 fatty acids
  - Saturated fats contain three saturated fatty acids
    - Saturated = all single C to C bonds (saturated in hydrogen)
    - Mostly solid and come from animals
  - Unsaturated fats contain at least one unsaturated fatty acid
    - Unsaturated = at least one double C to C bond (causes kinks in the chain)
    - Mostly liquid and come from plants

Triglyceride Structure



The first two fatty acid chains are saturated while the third fatty acid chain is unsaturated

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Phospholipids

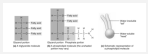
Function:

- Major component of cell membranes
- Helps provide selective permeability (water barrier)

Structure:

- Made of 1 glycerol, 2 fatty acids, and 1 phosphate
- Hydrophilic head and hydrophobic tails (amphipathic)

Phospholipid Structure



Steroids

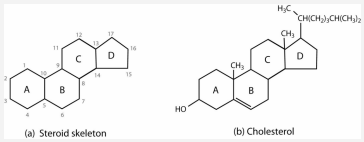
Function:

- Synthesize sex hormones
- Cholesterol: Needed for vitamin D and bile production
  - HDL "good kind" goes to the liver
  - LDL "bad kind" gets deposited on artery walls

Structure:

- Four connected rings of carbon, hydrophobic

Steroid Structure



Proteins

Functions:

- Structure and support: muscle, ligaments, fingernails, hair, skin
- Last resort energy source
- Hormones
- Receptors
- Antibodies
- Enzymes

Structure:

- Made of amino acids (20 in human body)
- Amine group, carboxyl group, variable R group
- Amino acids held together with peptide bonds
- Must have specific shape to function correctly

Protein Structure

Nucleic Acids

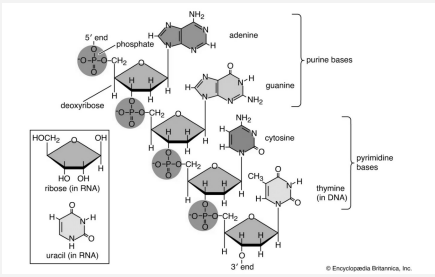
Function:

- DNA (deoxyribonucleic acid): encodes genetic information
  - Provides instructions for making proteins
- RNA (ribonucleic acid): helps decode DNA

Structure:

- Contains the elements CHONP
- Made of nucleotides

Nucleic Acid Structure



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